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UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

U. S. BUREAU OF MINES,
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U. S. Bureau of mines.

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SAFETY STANDARDS FOR ANTHRACITE MINES

REVISION OF I. C. 7282



1948

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I. C. 7449,
February 1948.

TN 295
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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

SAFETY STANDARDS FOR ANTHRACITE MINES^{1/}

Revision of I. C. 7282

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INTRODUCTION

These safety standards for anthracite mines have been prepared for use as a guide for Federal inspectors. They are a revision of "Tentative Inspection Standards for Anthracite Mines," published as Bureau of Mines Information Circular 7282 issued in May 1944 and used as a guide in Federal inspections. No provision made in these safety standards should be construed or operate to nullify any existing State statutes; they are intended to supplement the State statutes in the interest of increased mine safety. Mines are inspected in accordance with the Federal Coal-Mine Inspection and Investigation Act of 1941, Public Law 49, 77th Congress, H. R. 2082. Any unusual hazard noted by an inspector and not covered by these standards will be discussed in the inspection report, and suitable remedial procedure will be recommended.

ARTICLE I. - SURFACE STRUCTURES

Section 1. Breaker and cleaning plant.

a. Electric switches and controls in breakers and cleaning plants should be enclosed.

b. Where coal is dumped at or near air-intake openings, reasonable provisions should be made to prevent the dust from entering the mine.

Section 2. Lamp house

a. Naphtha or other flammable liquids in lamp houses should be kept in approved containers or other suitable dispensers.

b. Flame safety lamps should be permissible and maintained in permissible condition.

c. Flame safety lamps should be properly cleaned, examined, and assembled by a qualified lamp attendant or other competent person before each period of use. Lamp assembly should again be checked by the person using it immediately before he enters the mine.

d. When not in service, methane indicators, flame safety lamps, and electric cap lamps should be in the custody of competent persons responsible for maintenance and testing.

Section 3. Stairways, ladders, and platforms.

a. Stairways, elevated platforms or runways, and openings in floors should be equipped with handrails and with toeboards where necessary.

b. Ladders should be constructed substantially, anchored securely, well-maintained, and the rungs spaced suitably and uniformly. Backguards should be provided where necessary.

c. Where repairs are being made to the plant, proper scaffolding and proper overhead protection should be provided wherever necessary.

Section 4. Housekeeping.

a. Good housekeeping should be practiced in and around mine buildings and yards. Such practices include cleanliness, orderly storage of materials, and the removal of possible sources of injury, such as stumbling hazards, protruding nails, and broken glass.

Section 5. Wash houses.

a. Where wash houses are provided, they should be:

1. Provided with showers and an adequate supply of hot and cold water.
2. Kept clean and sanitary.
3. Well-illuminated.
4. Provided with suitable clothes lockers or hangers.
5. Kept well-heated; if necessary, heating equipment should be guarded against contact hazard.

6. Properly ventilated.
7. Provided with at least two exits.
 - b. Sanitary toilet facilities or latrines should be provided in or near each wash house.
 - c. Persons using wash houses and toilets or latrines should aid in keeping them in a clean and sanitary condition.

ARTICLE II. - MISCELLANEOUS SURFACE CONDITIONS

Section 1. Surface fire prevention.

- a. Oil, grease, and similar flammable materials should be stored in closed containers separate from other materials to minimize fire hazards to nearby buildings and the mine. If oil or grease is stored in a building, the building or room in which it is stored should be of fire-resistive material and should be well-ventilated.
- b. Tight metal receptacles should be provided for oily waste.
- c. Smoking in or about surface structures should be restricted to places where it will not create a fire or explosion hazard.
- d. Unless structures within 100 feet of mine openings are of fireproof or fire-resistive construction, fire doors should be erected at or near the portals or at other effective points in the mine openings to prevent smoke or fire from outside sources endangering men underground. These doors should be tested at least monthly to assure effective operation.
- e. A fire extinguisher or a container of clean dry sand or rock dust should be readily available, and combustible surroundings should be wetted before and after electric or acetylene welding or cutting.

ARTICLE III. - TIMBERING

Section 1. Timbering system.

- a. Methods of systematic timbering suitable to the roof conditions encountered in the separate veins should be adopted at each colliery or mine. These should be considered the minimum requirements, irrespective of the firmness of the roof. Additional timbering should be provided where necessary.

- b. Timbering methods should be complied with by workmen and officials.

Section 2. Timber supply and timbering.

- a. Adequate supplies of good-quality and ample-size timbering materials should be provided convenient to places of use.
- b. Permanent timbers or props should be stood as soon as the required space is available in working places. Where the nature of the roof or ribs

requires their use, temporary props, forepoles, or lagging should be used until permanent props or timbers can be placed.

c. Loose coal or rock in places where men are required to work or travel should be taken down or supported as soon as detected.

d. Timbers or props knocked out by blasting or otherwise dislodged should be replaced promptly. However, when necessary, temporary props should be stood until permanent timbers or props are replaced.

e. Broken and decayed timbers should be replaced promptly.

f. Only good-quality and ample-size timbering materials should be used.

Section 3. Testing of roof, ribs, and face.

a. Officials should examine roof, ribs, and face in working places visited, and the conditions of the roof, sides, and timbering along haulageways and travelways should be inspected. Officials should see that dangerous conditions are corrected promptly.

b. Face workers and other employees exposed to hazards from falls of roof or coal should examine their places and test roof and ribs thoroughly before beginning work and at frequent intervals during the shift. Dangerous conditions should be corrected before other work is begun.

c. Workmen and officials should use the sound-and-vibration method when testing roof, ribs, and face.

d. Before loose roof is taken down, the adjacent roof should be examined carefully and tested properly.

e. Suitable roof-testing bars should be provided for testing the roof, face, and sides. Conveyors and machines should be stopped while tests are being made.

f. Where there is danger of coal or rock falling or rolling on a person, it should be taken down or spragged securely.

Section 4. Removal of timber.

a. The roof should be examined carefully and tested properly before a safety prop or timber (timber set) is removed; and, where necessary, an additional safety prop or timber (timber set) should be placed.

Section 5. Other safety practices.

a. When loose roof, ribs, or face material is being pried down, a bar of suitable length should be employed and used in a proper manner.

b. In slopes and in the main haulageways timber legs or props should be hitched into the ribs or walls. Where this is not practicable, substantial guardrails should be placed on, or spacers placed between, the props or legs of timber sets.

c. Suitable cap pieces should be used atop props where the inclination of the vein will permit their use; the end of a prop or timber leg should be hitched into the bottom.

d. Where needed in pillar work, break-line props, cogs or cribs should be erected at the loose ends of pillars and pillar stumps.

ARTICLE IV. - EXPLOSIVES AND BLASTING

Section 1. Surface magazines.

a. Separate surface magazines should be provided for the storage of explosives and detonators.

b. A surface magazine for storing high explosives in amounts exceeding 125 pounds should be:

1. Reasonably bulletproof and constructed of incombustible material or covered with fire-resistive material. If a magazine is so located that it is possible to fire bullets directly through the roof into the explosives, the roof should be made bullet-resistive by material of construction, or by a ceiling that forms a tray containing not less than a 4-inch thickness of sand, or by other methods.
2. Provided with a door or doors constructed of 3/8-inch steel plate lined with a 2-inch thickness of wood, or of a thinner steel plate with a greater thickness of wood at the ratio of 1 additional inch of wood for each 1/8-inch decrease in the thickness of the steel plate, or of other materials which will make them at least equally fire- and bullet-resistive.
3. Provided with a floor made of wood or other nonsparking material and have no metal exposed inside the magazine.
4. Provided with suitable warning signs so located that a bullet passing directly through the face of a sign will not strike the magazine.
5. Provided with properly screened ventilators.
6. Provided with openings for entrance and ventilation only.
7. Kept locked securely when unattended.
8. Grounded, if constructed of metal or if metal-covered.

c. Surface magazines for storing black blasting powder or detonators need not be bulletproof, but they should be in accordance with the other recommendations for storing high explosives.

d. High explosives or black blasting powder in amounts of 125 pounds or less or 5,000 detonators or less should be stored in accordance with Section 1b and 1c, or in box-type magazines. Box-type magazines may also be used as

distributing magazines when the quantities do not exceed those mentioned. Box-type magazines should be strongly constructed of 2-inch hardwood or 3-inch softwood or other equally substantial material. A metal magazine should be lined with nonsparking material. No magazine should be placed in a building containing oil, grease, gasoline, waste paper, or other highly flammable material, nor should a magazine be placed less than 20 feet from a stove, furnace, open fire, or flame.

e. Where practicable, permanent explosives-storage magazines should be not less than 200 feet from any vital structure, or from any mine shaft, tunnel, or slope opening to the surface.

f. A magazine used for the distribution of explosives or detonators on the surface should be built in accordance with the standards for the construction of a storage magazine. The supply kept in a distributing magazine should be limited to not more than 3 days' supply or more than 3,000 pounds of explosives. Explosives and detonators may be distributed from the same magazine if separated by at least a 6-inch substantially fastened hardwood partition or the equivalent.

g. The area surrounding the magazine for not less than 25 feet in all directions should be kept free of rubbish, dry grass, or other materials of a combustible nature.

h. If the explosives magazine is illuminated electrically, the lamps should be of explosion-proof type and the wiring in conduit. The switch should be outside the building.

i. Only nonmetallic tools should be used for opening any type of explosives container. Extraneous materials, other than blasting supplies, should not be stored in an explosives or detonator magazine.

j. Smoking, carrying smokers' articles, or open flame should be prohibited in or near any magazine, or while explosives or detonators are being handled.

Section 2. Underground transportation.

a. Detonators should be transported in closed nonconductive containers, or in the original unopened containers. Attendants only should be permitted to ride on cages or trips carrying detonators, unless the detonators are in substantial, rigid, nonconductive containers.

b. Explosives should be transported in suitably constructed explosives cars or boxes, or in the original unopened containers. Attendants only should be permitted to ride on cages or trips carrying explosives.

c. When explosives and detonators are hauled in the same explosives car or in the same special container, they should be separated by at least a 4-inch substantially fastened hardwood partition or the equivalent.

1. The bodies and covers of special cars should be constructed substantially of nonconductive material.

2. Special containers should be of wood approximately 2 inches in thickness; they should be fully insulated.
 3. Trips carrying explosives should not be hauled into or out of a mine within 5 minutes preceding or following man-trips. When traveling with the air current, the explosives trip should precede; if against the air current, the man-trip should precede.
- d. Explosives and detonators transported underground by belt should be transported under the following conditions:
1. In the original unopened containers or in suitably constructed boxes of nonconductive material.
 2. Ample clearance should be maintained between the tops of explosives and detonator containers and the roof, timbers, or other obstructions.
 3. Suitable loading and unloading stations should be provided.
 4. An attendant and stop controls should be provided at each loading and unloading station.
- e. Explosives or detonators should not be transported on flight or shaker conveyors or by scraper loaders.
- f. Explosives and detonators should not be carried by the same person at the same time.

Section 3. Underground storage.

- a. Explosives and detonators for use in a working place:
 1. Should be kept in separate well-constructed nonconductive boxes or in a well-constructed nonconductive two-compartment box having a securely fastened separating partition of wood not less than 4 inches in thickness.
 2. Should be kept in these boxes at safe locations removed from the working faces and at safe distances from electric wires and haulage tracks, and tools or other materials should not be stored with explosives or detonators. In pillar work, the foreman should designate a safe place where explosives should be kept.
 3. Should be limited in quantity to as nearly a shift's supply as possible.
- b. If underground operation boxes are used, they should be:
 1. Of suitable construction. If metal, they should be provided with a lining of nonconductive material.

2. Placed in a crosscut (heading) or abandoned chamber or breast neck at a safe distance from roadways; at least 15 feet from trolley or power wires; and in a dry place.
3. Kept locked at all times, except when explosives supplies are being placed in them or removed.
4. Protected from falls of roof and sides.
5. If detonators are kept in the same operation box with explosives, a 4-inch wooden partition should separate the explosives from the detonators.
6. The quantity of explosives or detonators in an operation box should be limited to as nearly a day's supply as possible.
7. Only nonmetallic tools should be used for opening any type of explosives container.

Section 4. Blasting practices.

The Bureau of Mines is opposed unalterably to the use of nonpermissible explosives in any form in underground mines. However, if any of these explosives, including black powder in any form or dynamite, are used, special safety precautions should be taken.

- a. Permissible explosives only should be used for blasting coal and should be used as follows:
 1. Blasts should be fired only with electric detonators of proper strength.
 2. Blast holes should be charged and fired only by certified persons.
 3. Blast holes should be placed properly, and they should be cleaned before being charged.
 4. Blast holes should be stemmed adequately.
 5. Only wooden tamping bars should be used.
 6. Electric power should be cut off equipment and trailing cables before explosives are taken to the face, and the electric power should remain off until blasting has been completed and the working place examined carefully.
 7. Primers should be prepared immediately before loading, in a place removed from tracks, trolley wires, power lines, trailing cables, pipe lines, steel ropes, and conveyor pans, and at or near the face, where feasible.
 8. Leg wires of electric detonators should be kept short-circuited until ready to connect to the blasting circuit.

9. Mixed charges should not be placed or fired in any blast hole.
 10. The use of mudcap or other open, unconfined shots should be restricted to battery starting when no gas or fire hazard is present and only when it is otherwise impracticable to start the battery; similarly, the use of unconfined "shake" shots in working places and other places in pitching veins may be permitted when necessary to bring down loose hanging coal that is too hazardous to take down by other means. Only permissible explosives should be used for these purposes.
 11. Workmen should never go inside a battery to start the flow of material. A charge of explosives may be attached to a suitable pole for insertion inside the battery, or an equally safe method should be employed.
 12. Blasts should not be fired from a power circuit or signal line.
 13. In a gassy mine, tests for gas should be made before blasting and after blasting before any other work is done in the place. Examinations for fire should be made as soon as practicable after blasting in a place in any mine.
 14. A blast should not be fired in any place where methane can be detected with a permissible flame safety lamp.
 15. Only the person who places the charge should remove the shunts and fire the blast.
 16. Explosives should not be taken to working faces until all is in readiness to complete the charging, and each hole or series of holes should be fired immediately after charging.
 17. Before commencing work after firing a blast, the miner should examine his working place for dangerous conditions before his laborer or assistant enters the place.
 18. Ample warning should be given before blasts are fired. When places closely approach each other, the employees of each place should withdraw to a safe location before blasting is done.
- b. Nonpermissible explosives. (Black Blasting Powder).
1. Should not be used in a mine that is "gassy," as defined in ARTICLE V, Section 9a.
 2. Should be fired only with electric squibs and electric blasting units.
 3. Should be stemmed tightly to the collar of the hole, and wooden tamping bars only should be used.
 4. Blasts should be fired singly.

5. Should be used in accordance with the provisions contained in ARTICLE IV, Section 4a (excepting paragraphs 1, 4, 13, and 14) and Sections 5 and 6.

c. Nonpermissible explosives. (Dynamite).

1. Dynamite should not be used for blasting coal in underground mines. However, if dynamite is used for blasting rock in underground mines, it should be used in accordance with the provisions of ARTICLE IV, Sections 4, 5, and 6 (excepting 4b).

Section 5. Blasting cables or firing lines.

a. Blasting cables or firing lines should be:

1. Well-insulated and long enough to permit the miner to fire from a place of safety which is out of line of the blast by at least one 90° turn.
2. Kept short-circuited at the battery end until ready to attach to the blasting unit.
3. Staggered in length at the detonator end to prevent short circuiting.
4. Wound up after each blast or supported suitably.
5. Kept away from track, power wires, pipe lines, and other possible sources of active or stray currents.

b. Both wires of a permanently installed blasting line should be broken and short-circuited a safe distance from the face until ready to be used.

c. Separate blasting lines and separate blasting stations should be provided for each working face, blasting stations to be at least 20 feet apart to prevent the possibility of connecting to the wrong line.

Section 6. Misfires.

a. A waiting period of not less than 15 minutes should elapse before any person returns to the face where a misfire has occurred in electric blasting. After failure of a blast, the blasting cable should be disconnected from the source of power and the battery ends short-circuited before the shot-firing line and electrical connections are examined. The examiner should begin at the battery end and progress toward the working face.

b. If the examination reveals the cause of a misfire is not in the firing line outside the blast hole or holes, the misfire should be handled under the supervision of a certified mine official, and no other work should be done in the place until the misfired charge is removed by blasting.

c. Explosives should be removed only by firing a separate charge at least 2 feet away from and parallel to the misfired charge. A careful search should be made to recover the undetonated charge in the working place and, if necessary, in the preparation plant.

ARTICLE V. - VENTILATION AND MINE GASES

Section 1. Main fans.

a. A main fan should be:

1. Installed on the surface. (Applies to a new installation or relocation of a fan.)
2. In a fireproof housing. If present installation does not meet this recommendation, such installation should be made reasonably fire-resistive.
3. Provided with a fireproof air duct. If the present duct does not meet this recommendation, it should be made reasonably fire-resistive.
4. Offset at least 15 feet from nearest side of the mine opening. (Applies to a new installation or relocation.)
5. Provided with ample pressure-relief or explosion doors, or with a weak-wall section of the fan duct, formed by fastening metal plates of a fan-duct section with soft metal rivets or the equivalent. (This applies to a new installation or relocation.)
6. Equipped in a new installation to permit prompt reversal of air flow.
7. Operated continuously, except when the mine is shut down for an extended period.
8. Provided with a pressure-recording instrument.
9. Provided with an automatic device to give alarm when the fan slows or stops, unless the fan is constantly attended.
10. Inspected daily and a record of the inspection kept available.
11. On a power circuit independent of the mine circuit at a gassy mine.

b. If a main fan is installed underground, the following precautions should be observed:

1. The surroundings of the fan should be fireproof or made fire-resistive.
2. The fan should be operated continuously, unless the mine is shut down for an extended period.
3. The fan should be inspected at least once each 8-hour period while it is in operation and a record of the inspection kept available.

4. In a gassy mine the fan assembly should be permissible, or the fan motor and controls should be explosion-proof types if in return air.

c. When the main fan of a gassy mine fails or is stopped, immediate action should be taken to cut off the electric power and withdraw the workers from the face regions. If normal ventilation is restored within 20 minutes, gas examinations should be made, and if the mine is found free of methane, power may be restored and work resumed. If normal ventilation is not restored within 20 minutes, withdrawal of the men from the entire mine should begin at once. The entire mine should be inspected and any gas found should be removed before workmen reenter.

d. The area around a fan should be kept free of dry grass, brush, and rubbish for at least 100 feet in all directions.

Section 2. Booster and auxiliary fans.

a. A booster fan should be used only when improvement of airways is not practicable or construction of a new ventilation opening is not feasible. When used for such reason:

1. The fan should be installed and operated in accordance with the provisions of Section 1b, ARTICLE V.
2. The fan should be so located as to minimize the recirculation of air.
3. Where practicable, passage by the fan should be by means of an air lock, each door of which should have at least 30 square feet of cross-sectional area and open automatically when the fan stops; the distance between the doors should exceed the combined length of a trip of cars and locomotive or animal.
4. If the fan fails, the procedure as set forth in Section 1c, ARTICLE V, should apply to the mine section dependent upon the booster fan.

b. Auxiliary fans or blowers with tubing should not be used unless approved methods of ventilation are impracticable. However, if used, they should be:

1. Installed and operated in accordance with Section 1b1, 1b3, and 1b4 of ARTICLE V.
2. Installed in air that meets the requirements of Section 9, ARTICLE V. Where such fans are installed in air that has passed through active workings or worked-out or abandoned areas, flame-safety-lamp tests should be made at least once each working shift. If a gassy mine, tests with a flame safety lamp should be made at least twice each working shift.
3. So located as to avoid recirculation of air.
4. Equipped with well-maintained and well-aligned tubing.

c. If an auxiliary or blower fan stops in a gassy mine, a thorough examination for methane should be made in the places dependent upon the fan before it is started.

Section 3. Volume of air.

a. A split ventilating system utilizing air bridges should be used wherever possible.

b. Air courses should be maintained in a manner that will permit the free flow of air.

c. The volume of air should be at least 200 cubic feet a minute for each person in any split. This volume should be considered a minimum requirement; additional air should be provided as may be required to dilute adequately and carry off flammable and harmful gases, smoke, and fumes.

d. The volume of air reaching the face of each working place should be at least 200 cubic feet a minute for each man working in the place and as much more as may be required to dilute, render harmless, and sweep away noxious or dangerous gases, smoke, and fumes. In robbing areas where the air currents cannot be controlled and measurements of the air cannot be obtained, the air should have perceptible movement.

e. Air measurements should be made by the mine foreman, his assistants, or other certified officials at least once each week at or near the mouth of the main intake and return of the mine and also in or immediately adjacent to the last crosscut on each air split, at or near the face of each airway or gangway, and at the cross heading or crosscut nearest the face of both the inby and outby chamber, breast, or chute where men are employed. Tests should be made with a flame safety lamp or other methane indicator in such splits and in the main return. Records of these measurements and tests should be kept available in a book furnished for this purpose.

Section 4. Coursing of air.

a. Main-intake and main-return air currents in mines should be in separate shafts, slopes, or drifts. It is recognized that some present anthracite mines use the same shaft for intake- and return-air currents and that sinking a new shaft or use of other connections is economically impracticable; however, excepting the buntons and guides, such a shaft and the partition wall therein should be fire resistive. In a new shaft designed to conduct both intake- and return-air currents, the shaft, except the buntons and guides, should be wholly fireproof and the curtain wall constructed substantially and airtight.

b. Underground stables, battery-charging stations, and transformer stations containing liquid-filled transformers should be well-ventilated, where practicable, by separate splits of air conducted through vents to the return air courses.

c. Changes in ventilation that may affect the safety of the men should be made when the mine is idle and with no men in the mine other than those engaged in changing the ventilation.

Section 5. Crosscuts and stoppings.

a. The face of any chamber or breast should not be advanced more than 60 feet beyond the nearest open pillar heading or crosscut.

b. Chutes or crosscuts between gangways and airways or headings in coal should be made at not more than 80-foot intervals to assure adequate ventilation at the faces. In rock gangways, airways, etc., when it is impracticable to make air connections at 80-foot intervals, provisions should be made to ventilate the faces.

c. Headings or crosscuts between chambers, breasts, or chutes, except the one nearest the face, should be closed.

d. Chambers or breasts should not be worked off any heading, gangway, or roadway in advance of the last crosscut or chute between the gangway and airway, even if line brattices are utilized.

e. Adjacent gangways and airways and adjacent breasts or chambers should be connected at the faces by headings or crosscuts before they are abandoned.

f. Stoppings between intake and return airways should be constructed substantially of incombustible material, except that one temporary stopping of wood or brattice cloth may be erected between the last permanent stopping and the last crosscut.

Section 6. Doors and air bridges.

a. Main doors should have attendants whose constant duty should be to open them for transportation and travel and prevent them from standing open longer than is necessary for persons or cars to pass through, unless a man precedes and follows the trip to open and close doors. Where self-acting doors are used, attendants are not needed.

b. Main doors should be:

1. Installed in pairs to form air locks; the air locks should be long enough to contain an entire trip and be ventilated sufficiently to prevent an accumulation of gas within the enclosed area.
2. Self-closing.
3. Kept closed except when men, equipment, or trips are passing through the doorway. Haulage employees and other persons should see that doors are closed before leaving them.

c. At a main door an emergency door should be provided and kept standing open and so fixed that it can be closed at once, if necessary.

d. An air bridge should be constructed tightly of incombustible materials and have ample area to pass the necessary quantity of air.

Section 7. Line brattice.

a. Where needed, a line brattice should be used to conduct the air from the last open crosscut to a working face in sufficient quantity to supply the workmen at the face and to dilute and remove flammable and harmful gases and smoke or fumes. The line brattice should be constructed substantially so as to minimize air leakage, and it should be extended close enough to the face to insure proper ventilation.

b. The space between the rib and the line brattice should be large enough to permit free flow of air, and it should be kept free of obstructions.

Section 8. Old workings.

a. Abandoned workings should be posted to warn unauthorized persons against entering the territory.

b. Where it is not practicable to seal worked-out or abandoned parts of an active mine, these worked-out or abandoned parts should be ventilated so far as practicable.

c. Abandoned parts of a mine that are accessible should be carefully examined at least once a week by the mine foreman or a designated assistant. Records of these examinations should be kept available.

d. In every sealed area, one or more stoppings should be fitted with a pipe and cap or valve to allow sampling of the air behind the seals or to provide a means of determining any existing hydrostatic pressure.

e. Working places should not be ventilated by an air current that has passed through abandoned workings or worked-out areas of a mine. Where physical conditions are such that ventilation by an air current that has passed through abandoned workings or worked-out areas is necessary, definite measures, such as increased supervision and frequent tests of air, should be taken to assure that the air is of good quality at all times. In a gassy mine, tests of the air should be made at least twice each working shift with a flame safety lamp and records kept available.

Section 9. Mine gases.

a. A mine should be classed gassy when 0.25 percent or more methane is found in any open workings by systematic search during which air samples are collected, or if records establish the fact that methane has been detected with a flame safety lamp or if it has been ignited, or if the mine is connected to a "gassy" mine and the connection is not sealed by water, a tightly caved area, or a suitable artificial barrier.

b. If flammable gas can be detected in the air of a working place with a flame safety lamp, or if the air contains more than 1 percent flammable gas as determined by an electric methane detector or by chemical analysis, the ventilation should be improved immediately. If air in a working place contains more than 2 percent flammable gas (slightly less than 1/2-inch cap on a testing or low flame of a flame safety lamp), the workers should be withdrawn until the ventilation is improved. By "air of a working place" is meant air at least 1 foot from the face.

c. If the air immediately returning from a split that ventilates any group of active workings contains more than 1.0 percent of flammable gas, as determined by chemical analysis or by other recognized means of accurate determination, the ventilation should be improved. If this air contains more than 1.5 percent flammable gas, the workers should be withdrawn until ventilation has been improved.

d. The ventilation should be improved if the air in a working place or travelway contains less than 19.5 percent oxygen, more than 0.5 percent carbon dioxide, or any poisonous or noxious gases as determined by chemical analysis.

e. In virgin territory where methane is liberated in large amounts and a large volume of air is provided, the methane content in a split may exceed 1.5 percent but should not exceed 2.0 percent. Only permissible electric equipment should be used; the air should not pass over energized trolley or other bare power wires; and a certified official should continually test the air for gas content during mining operations.

Section 10. Examination for gas and dangerous conditions.

a. At least two permissible flame safety lamps in proper working condition should be available, and at least two persons should be well-informed as to the safe maintenance and use of flame safety lamps at each mine.

b. Only permissible methane detectors or air samples and analyses should be used for determining methane. (Permissible flame safety lamps are a type of permissible methane detector.)

c. Persons required to test for gas and oxygen deficiency should have permissible flame safety lamps and should be instructed thoroughly in their use and limitations.

d. Preshift examinations should be made in all mines by certified officials or other competent persons designated by management. The examiners should:

1. Begin examinations of the mine not more than 3 hours before the entrance of first-shift workmen into any mine section. In multiple-shift operations, preshift examinations should be made within 3 hours of the shift starting time in those places that were idle during the preceding shift.
2. Examine every working place and places adjacent to live workings and active roadways for explosive gas and oxygen deficiency; examine seals and doors; inspect the roof, face, and rib conditions in working places and the roof and ribs along roadways and travelways; the approaches to abandoned workings; and accessible falls in active sections for explosive gas and other hazards.
3. Mark their initials and the date at or near the face of each place examined.

4. Place a danger sign across each entrance to every place where a dangerous condition is found. The sign should be removed only by a certified official after the danger has been removed.
5. Upon completion of an examination, report to a proper official on the surface or at a designated underground station any defects found before the men enter the mine or pass such designated station.
6. Record with ink the results of their inspections in a book kept on the surface for that purpose. Similar records may be kept at designated underground stations.
 - e. The mine foreman or his assistant should read and countersign the preshift examiner's report. Where such a report discloses any dangerous condition, prompt action should be taken to have the dangerous condition corrected. The corrective measure should be recorded.
 - f. Accumulations of gas should be removed under the direct supervision of a foreman or other official, and no men should be permitted to work, or electric equipment be operated, in the return of the split while gas is being removed.
 - g. Accessible worked-out and abandoned areas and the entrances to caved areas should be examined for gas at least weekly and the results recorded.
 - h. In a gassy mine, each miner should be provided with a permissible flame safety lamp in good condition, and he should make frequent tests for gas in his working place. Officials should make similar tests during visits to working places.
 - i. Records of daily and weekly inspections should be kept available.

ARTICLE VI. - CONTROL OF DUST

Section 1. Sources and accumulations of dust.

a. Dry coal dust and pulverized traction sand of locomotives should not be permitted to accumulate along haulage roads.

b. Rock drilling with percussion drills should be done wet, except that approved respirators may be worn when exposure is for short periods.

Section 2. Allaying dust.

a. Where mining operations raise an excessive amount of dust into the air, water or water with a wetting agent added to it, or other effective methods, should be used to allay such dust at its source.

ARTICLE VII. - TRANSPORTATION

Section 1. Hoisting.

a. Hoists used for handling men should be equipped with automatic overwind, overspeed, and stop controls that are tested daily.

b. At the beginning of a shift and after a hoist has been idle for an extended period, the cages should be operated at least one round trip before men are handled. A similar procedure should be followed in slope hoisting, except that an attendant may ride on the trip.

c. A hoist should be equipped with brakes capable of stopping and holding the fully loaded unbalanced cage or trip of cars at any point in a shaft, slope, or on an incline.

d. An accurate and reliable indicator of the cage or trip position should be so placed as to be in constant view of the engineer, unless the position of the trip is clearly visible to the engineer at all times.

e. Hoisting equipment should be inspected each day used, and a record should be made by the person making the inspection and the record kept available.

f. A hoisting rope should be adequate in size to handle the maximum load with a factor of safety as defined in the American Standards Association's Wire Rope Standards.

g. The rope should make at least three full laps on the drum when extended to its maximum distance, and it should make at least one full lap around the drum shaft or around a spoke of the drum (in case of free drum) and the end of the rope should be fastened securely by means of clamps.

h. The rope should be fastened to its load by a spelter-filled socket or by a thimble and clamps. When resocketing is done, a sufficient length should be cut off the end of the rope so that a new section of rope will be on the head sheave when the cage or trip is at the loading position.

i. In no event should a rope be used to handle men:

1. Which reveals more than six (6) broken wires in any single pitch length or lay of rope.
2. When inspection indicates a dangerous amount of corrosion or distortion.

j. At least two independent methods of signaling, one of which should be audible, should be provided at all landings in shafts and slopes.

k. The signal code in use at the mine should be posted prominently in the engine room in easy sight of the hoisting engineer and at all places where signals are given.

Section 2. Cages and shafts.

a. Cages used for hoisting men should be of substantial construction, kept in good repair, and provided with:

1. Suitable steel bonnets.
2. Adequate side protection.

3. Safety gates across the ends when men are handled.
 4. Handholds.
 5. Bridle chains.
- b. Cages should be equipped with safety catches that act quickly and effectively in an emergency. These catches should be inspected each day the cages are used. A drop test of the safety catches should be made at least every 2 months, if men are handled. Records should be kept of the inspections and tests and the records kept available.
- c. Cages, guides, and hoisting shafts should be maintained in good condition and inspected each day used. Records of such inspections should be available.
- d. Any opening in the cage floor large enough for foot entry or larger should be covered, and movable platforms of cages should be secured firmly before men are handled.
- e. A cager should be in charge at the top and one at each underground landing of the shaft from which men are handled during periods when men are regularly transported. A cager riding the cage and giving the signals is acceptable.
- f. Shafts should be equipped with safety gates at the surface and at all underground landings. The gates should be so constructed that men or materials cannot go through or under them and into the shafts; preferably, these gates should be self closing.
- g. Positive stopblocks or derails should be suitably placed at shaft landings.
- h. Tools or other material that might cause injury should not be carried in the cage with men; however, this should not apply to equipment and material requiring attendants.
- i. A cage in which men are being transported should be operated at a safe speed; preferably, the speed of the cage should not exceed 900 feet a minute.
- j. A run-around should be provided for travel at the bottom and at each intermediate landing of a hoisting shaft. The run-around should not be less than 5 feet high and 3 feet wide.
- k. While engaged in repair work in or above shafts, workmen should wear safety belts. Where a platform is being used, a second or safety platform should be placed not more than 10 feet beneath the working platform.

Section 3. Haulage roads.

- a. Haulage roads should be kept well-drained, well-ballasted, and reasonably free of debris.

b. On mechanical haulage roads, rails should be connected at the joints by angle bars or plates or be welded.

c. Track should be properly aligned and free from broken rails, defective switches, and defective or improperly aligned frogs.

d. Track switches on mechanical haulage roads should be complete with throws and bridle bars.

e. Switch throws should be placed on the clearance side. Where conditions prevent the installation of switch throws on the clearance side or if adequate clearance cannot be provided, they should be placed in suitable shelter holes.

Section 4. Clearance and shelter or safety holes.

a. Where practicable, a clearance of at least 24 inches from the widest part of equipment to ribs or obstructions should be maintained on at least one side of new haulage roads. The clearance side should be the side opposite the trolley wire, where feasible.

b. The clearance space along a haulage road or conveyor should be kept free of loose rock or coal, supplies, or other loose material.

c. Shelter holes should be:

1. Provided along haulageways where adequate clearance is not available. Where conditions are such that clearance or shelter holes cannot be maintained, signs warning of restricted clearance should be posted, and trips should be so operated as to protect foot travelers.

2. On the clearance side where practicable.

3. Suitably indicated or illuminated where necessary.

4. Not more than 150 feet apart. (Chamber, breast, or chute necks and crosscuts or breakthroughs may be considered as shelter holes.)

5. Provided at each mine door where adequate clearance is not available.

6. Kept clean and free of obstruction.

d. Safety holes, adequate for man shelter, should be provided in safe locations at landings of slopes and planes and should be kept free of obstructions.

Section 5. Haulage equipment.

a. Locomotives should be equipped with suitable rerailers, jacks, and other necessary tools for rerailing cars or locomotives. Improvised methods should not be used.

b. Locomotives should be provided with efficient headlights and warning devices that are maintained in good condition.

c. Nonpermissible internal-combustion engines or other machinery that emits noxious fumes that may be injurious to the health of workmen should not be used underground.

d. If a hoist is used underground, Section 1, ARTICLE VII, applies.

e. Haulage equipment should be maintained in safe condition.

Section 6. Safety devices and practices.

a. Sprags, chains, or suitable car blocks should be used on all standing cars regardless of grade. If cars have brakes, they should be set. The use of chips of wood, pieces of coal or rock, or similar makeshifts should not be considered adequate blocking.

b. Unless a more effective device is provided for stopping and holding cars on a grade, an effective drag should be used on a trip ascending a grade where, in the judgment of the inspector, the use of a drag would be a definite safety measure.

c. In a gangway that rises, standing cars should be securely blocked, and a stopblock or derail should be placed between the cars at or near the face and the first outby chute or other loading place.

d. In a gangway that dips, workmen at the face should be protected by a stopblock or derail placed a safe distance from the face.

e. While men are working at a chamber or gangway face, a positive stop-block or derail should be placed across the chamber or gangway track or the switch kept closed to prevent cars being inadvertently pushed or run into the place.

f. Cars placed for loading in chambers and at chutes and other working places should be effectively blocked, regardless of grade.

g. Effective methods should be used to control cars while being loaded at chutes and other loading places.

h. Slides, sprags, or car brakes should be used on descending grades where the locomotive is not adequate to control the trip.

i. Efficient trip lights, other than flame type, should be used on the rear of locomotive-pulled trips and on the front of locomotive-pushed trips. Permissible trip lights should be used in gassy mines.

j. Unnecessary pushing of cars or trips by locomotives should not be permitted.

k. Only authorized persons should operate locomotives or hoists.

l. Riding on locomotives or trips other than man-trips should be prohibited except to those operating the trips.

m. Riding on top of loaded cars or between cars should be prohibited. Men should not ride front bumpers of cars unless necessary to perform their duties.

n. A motorman or brakeman should not get on or off a locomotive, car, or trip in motion, except that a brakeman may get on or off the rear end of a slowly moving trip to perform his duties.

o. Backpoling should be allowed only at places where the trolley pole cannot be reversed, or when traveling up extremely steep grades at low speed.

p. At least one car should be placed between the locomotive and cars or trucks carrying rails, timbers, pipes, or other long material.

q. Cars should not be coupled or uncoupled by hand while they are in motion unless a coupling hook or an equally effective device is used.

r. Any slope, plane, or incline having a knuckle near the top should have a stopblock or derail at or above the knuckle and a derail near the bottom if men are endangered at the bottom.

Section 7. Transportation of men.

a. An official or other authorized person should be in charge of and accompany each locomotive-hauled man-trip.

b. Man-trips should be operated at safe speeds.

c. Man-trips should not be operated behind loaded trips on ascending grades or in front of loaded trips on descending grades.

d. Only the number of men that can be comfortably seated should be permitted to ride in a man-car.

e. Man-trips or man-cars operated in slopes or on planes should be provided with safety chains or ropes that connect the first car to the main rope and extend around or through all cars of the trip. (Note: Safety chains connecting the first car to the main rope and safety chains on each side of other cars of the trip, in addition to the regular drawbar couplings of cars, is acceptable.)

f. Persons other than the brakeman should not be permitted to ride on the rear bumper of a man-trip, and no person should be allowed to ride between cars.

g. The man-trip should come to a full stop before men load or unload. The men should proceed in an orderly manner to and from man-trips.

h. Suitable places with seats should be provided at junction points where men may congregate while waiting for man-trips; they should be where

the lives of persons waiting would not be jeopardized by run-away cars or trips or the wrecking of cars or trips.

i. Only tools and supplies that can be carried entirely inside a separate car should be hauled on a man-trip.

j. Trolley and other energized electric wires should be guarded adequately at man-trip stations where there is a possibility of any person coming in contact with the wires.

k. Where belts are used for transporting men:

- l. A minimum clearance of 18 inches should be maintained between the top of the belt and the roof or collars, projecting equipment, or other objects.
2. The belt speed should not exceed 250 feet a minute while men are being transported.
3. Suitably illuminated loading and unloading stations should be provided.
4. Stop controls should be provided at loading and unloading stations.

ARTICLE VIII. - ELECTRICITY

Section 1. Surface transmission lines.

a. Overhead high-potential power lines should be placed at least 15 feet above the ground and 20 feet above driveways, and they should be supported and guarded adequately to prevent contact with other circuits.

b. Surface electric equipment and overhead power circuits should be protected against lightning or voltage surges.

c. High-potential power lines should be protected by circuit breakers, fuses, or both.

d. Electric wiring in all surface buildings should be so installed as to present minimum fire and contact hazards.

Section 2. Transformer stations.

a. Surface transformers within 8 feet of the ground should be within suitable enclosures (fence or building). Where the enclosure is metal, it should be grounded.

b. The gate or door to the transformer enclosure should be kept locked at all times, unless authorized persons are present.

c. Where surface transformers containing flammable oil are installed where they present a fire hazard (near mine openings and in or near combustible buildings), means should be provided to drain or confine the oil in case the transformer casing is ruptured.

d. Permanent underground electrical stations having transformers filled with flammable oil should have doorsills or catch basins to confine the oil in case of transformer leakage, rupture, or explosion.

e. Portable transformers containing flammable oil should be in fire-proof housings and should have doorsills or catch basins to confine oil in case of transformer leakage, rupture, or explosion.

f. New transformers purchased for use underground should be air-cooled or nonflammable-liquid-cooled.

g. DANGER - HIGH VOLTAGE signs should be placed on all transformer enclosures, high-potential switchboards, and other high-potential installations.

Section 3. Substations and switchboards.

a. A switchboard should:

1. Have ample working space around and back of it, free of rubbish and stored material.
2. Have an entrance at one end (both ends where feasible) to permit authorized persons to inspect, adjust, or repair apparatus back of the switchboard.
3. Have the entrances to the rear guarded against unauthorized entrance unless an attendant is on duty or the building kept locked.
4. Be lighted adequately.
5. Have controls readily accessible for emergency shut-down.
6. Have disconnecting switches on incoming power circuits.

b. Permanent underground substations should be in rooms of fireproof construction. Surface and underground substations should be kept free of refuse, and closed metal containers should be provided for oily waste.

Section 4. Power circuits.

a. Trolley and bare power wires should be:

1. Securely supported on insulated hangers; on straight runs where the trolley wire is 5 feet or more above the rail, the hangers should be not more than 30 feet apart, and where the wire is less than 5 feet above the rail, the hangers should be not more than 20 feet apart; on curves the hangers should be so spaced that the trolley wire may be disconnected at any one hanger without exposing the locomotive operator to a shock hazard.
2. Kept taut and not permitted to touch roof, rib, timbers, or doorframes.

3. Properly aligned.
4. Installed on the side opposite the clearance space and the shelter holes, where feasible.
5. Sectionalized by proper electric switches at suitable intervals; electric switches should be installed near the beginning of all branch lines.
6. Provided with sectionalizing switches where mine cars are stored on idle days.
7. Guarded adequately where men are required to pass or work under a wire, unless the wire is 6-1/2 feet or more above the top of the rail; on both sides of mine doors, if the wire is less than 7-1/2 feet above the rail.
8. Anchored securely and insulated properly at the ends.
9. Outby the last open crosscut and at least 150 feet from pillar workings where conditions permit.
10. In intake air or air containing less than 1.0 percent methane.
 - b. An electric circuit should be of ample capacity for the current carried.
 - c. Power wires, whether bare or insulated, except grounding wires, should be supported on or by well designed and installed insulators and should not touch timbers, roof, ribs, or other combustible material. (This does not apply to armored cable carried on metal supports.)
 - d. High-potential (600 volts or more) power cables in shafts, bore-holes, and underground passageways should be adequate for the service intended; installed in a permanent manner (armored cable, in conduit, suitable hangers) and guarded from mechanical injury. Cables (carrying less than 600 volts) in shafts, boreholes, and underground passageways should be adequate for the service intended and installed so as to minimize fire hazards and guard against mechanical injury to the cables. Such cables in underground passageways should be suspended adequately on suitable insulators.
 - e. Power wires, other than trolley wires, should be properly insulated when passing through doorframes, stoppings, and where they cross over other power circuits.
 - f. Power should be disconnected before repair work is done on electric equipment and accessories, such as trailing cables, feed wires, trolley wires, switches, junction boxes, or similar devices. A sign warning persons that repairs are being made on the circuit should be placed at the switch, or the switch handle should be locked in the disconnected position. If employees are required to make emergency repairs on energized trolley or feeder lines, they should wear protective clothing, such as insulated shoes and lineman's gloves.

g. Power should be disconnected from face equipment when it is not in use.

h. Where main haulage track is used for the return conductor, both rails should be well-bonded at every joint and cross-bonded at least every 200 feet. Switches should be well-bonded.

i. Where chamber or temporary haulage track is used for the return conductor, at least one rail of the track should be bonded.

j. Wiring in underground structures should be insulated and installed in a safe manner.

Section 5. Grounding.

a. Metal conduit, metallic sheathings and metallic armor of cables, and grounding conductors should be electrically continuous and grounded effectively.

b. Metallic frames, casings, and coverings of motors, generators, switchboards, mining machines, drills, and other electric equipment that can become "alive" through failure of insulation or by contact with energized parts should be grounded. The effectiveness of the grounding system should be assured.

c. Casings of transformers should be grounded unless protected by isolation (freedom of contact hazard by position).

Section 6. Circuit breakers and accessories.

a. Electric equipment should be protected against excessive overload by fuses or equivalent protective devices of the correct type and capacity. Wires or other conductive materials should not be used as substitutes for properly designed fuses.

b. Underground electric equipment and circuits should be provided with switches of safe design, construction, and installation.

c. Circuit breakers or overload relays should be provided to protect principal power circuits, and:

1. Where they are automatic, they should be set so that the circuits cannot be overloaded.

2. Where they are hand set, the handles should not be tied in place.

d. Switches and circuit breakers should be so placed that they are readily accessible and can be reached without danger of contact with moving or charged parts.

e. Disconnecting switches should be installed in all main power circuits at the bottoms of shafts and boreholes and other places where main power circuits enter the mine.

f. Dry wooden platforms, rubber mats, or other electrically nonconductive material should be kept in place at switchboards, motor-starting switches, and stationary electrical installations where shock hazards may exist.

Section 7. Telephone and signal systems.

a. Telephone service or other suitable means of communication should be provided from the surface to the bottom of each main shaft or slope and to within 1,500 feet of each working section of a mine.

b. Telephone wires other than cables should be installed on the side opposite power or trolley wires. Where telephone lines are installed on the same side as power or trolley wires, they should be insulated adequately.

c. Telephone and signal wires crossing power or trolley wires should be insulated adequately.

d. Telephone circuits on the surface should be protected by lightning arresters; a mine telephone circuit to the surface should be protected by a lightning arrester where the circuit enters the mine.

e. Telephone and signal wires should be supported on suitable insulators.

f. Bare signal wires that are readily accessible to persons should not carry more than 30 volts. (This does not apply to block-signal systems.)

g. Signaling switches should be insulated against shock hazards, regardless of the voltage.

h. In a gassy mine, signaling devices used at or near the face (such as is used in conveyor and scraper-loader mining) should be of a type that will not produce arcs or sparks or present other gas-ignition hazards.

Section 8. Electric face equipment.

a. When electrically driven equipment is purchased for use at or near the face in gassy mines, it should be of permissible or explosion-proof type approved by the Federal Bureau of Mines.

b. In gassy mines, junction or distribution boxes installed in working places or in return air should be permissible types.

c. Permissible equipment should be maintained in a good state of repair and in permissible condition.

d. Electrically driven equipment should not be taken into or operated in any place where 1.0 percent or more methane can be detected at any point not less than 12 inches from the face or rib with a flame safety lamp.

e. In all face workings in gassy mines where electrically driven equipment is operated, frequent inspections for methane should be made. If a dangerous condition exists, the machine should be stopped and the power cut off the trailing cable until such dangerous condition is removed.

f. In gassy mines where nonpermissible equipment is now being used, care should be taken to protect the workmen by making frequent examinations of the air for methane content.

g. Electric drills or other electrically operated rotating tools intended to be held in the hands should have the electric switch so constructed as to break the circuit when the hands release the switch or should be equipped with properly adjusted friction or safety clutches.

h. Cable-reel locomotives operated on unbonded track rails should be equipped with two-conductor trailing cables.

Section 9. Trailing cables.

a. When trailing cables are purchased for use underground, those having fire-resistive qualities should be procured.

b. Cables for portable and semiportable underground electric equipment should be provided with suitable overload protection, such as fuse-type power taps or circuit breakers, unless properly connected to permissible junction or distribution boxes.

c. Temporary splices in trailing cables should be made in a workmanlike manner, mechanically strong, and well-insulated.

Section 10. Underground illumination.

a. Electric light wires should be supported by suitable insulators and connected securely to the power conductors.

b. Electric lights, other than permissible or explosion-proof type, should not be used near any working face in a gassy mine.

c. Electric lights should be so placed that they cannot come in contact with combustible material.

ARTICLE IX. - SAFEGUARDS FOR MECHANICAL EQUIPMENT

Section 1. Face equipment.

a. The cutter chains of mining machines should be locked securely to prevent accidental movement while the machines are being moved or when parked.

Section 2. Shop and other equipment.

a. The following should be guarded adequately:

1. Gears, sprockets, friction devices, and couplings with protruding bolts or nuts.
2. Shafting and projecting shaft ends within 7 feet of floor or platform level.
3. Belt, chain, or rope drives within 7 feet of floor or platform.

4. Flywheels. (Where flywheels extend more than 7 feet above the floor, they should be guarded to a height of at least 7 feet.)
 5. Circular and band saws and planers.
 6. Repair pits. (Guards or covers should be kept in place when the pits are not in use.)
 - b. Machinery should not be repaired or oiled while it is in motion, unless oiling can be done without danger to the oiler.
 - c. A guard or safety device removed from any machine should be replaced before the machine is put in operation.
 - d. Mechanically operated grinding wheels should be equipped with:
 1. Safety washers and tool rests.
 2. Substantial retaining hoods, the throat openings of which do not expose more than a 90° sector of any wheel.
 3. Eyeshields, unless goggles are worn by the operators.
- ARTICLE X. - UNDERGROUND FIRE PREVENTION, FIRE CONTROL, AND MINE DISASTERS**
- Section 1. Fire prevention and control.**
- a. Each mine should be provided with suitable fire-fighting equipment adequate for the size of the mine, such as rock dust or dry sand at convenient places, water lines and hose, water or chemical fire trucks, and fire extinguishers.
 - b. Clean dry sand, rock dust, or fire extinguishers suitable from a toxic and shock standpoint should be provided and so placed at each electrical station (substations, transformer stations, permanent pump stations) as to be out of the smoke in case of a fire in the station.
 - c. Should a fire occur, the person discovering it and any persons in the vicinity of the fire should make a prompt effort to extinguish it.
 - d. If or when a fire has attained such proportions that an individual cannot extinguish it, he should report immediately the existence of the fire to an official of the mine, who should order all workmen from that part of the mine affected by the fire, except those needed for fire fighting.
 - e. Underground storage places for lubricating oil and grease in excess of a 2-day supply should be of fireproof construction.
 - f. Lubricating oil and grease kept in face regions or other working locations should be in portable, closed, metal containers.
 - g. Underground structures (transformer stations, battery-charging stations, substations, foremen's offices, stables, pump rooms, etc.) should be of fireproof or fire-resistive construction. Where the fireproofing material is in contact with timber or coal, it should not be of metal.

h. Hay and straw should be transported from the surface to underground stables in incombustible closed cars. These materials should be stored in a fireproof structure apart from the stable or in a fireproof compartment within the stable.

i. Where practicable, power wires underground should be deenergized on idle shifts and idle days.

Section 2. Mine disasters.

a. When a disaster occurs in a mine, the nearest office of the Federal Bureau of Mines and the proper State inspection authorities should be notified promptly of such disaster. All facilities of the mine should be made available for recovery operations.

b. After a disaster, immediately following the recovery work and before the wreckage and debris of the disaster are disturbed, a committee of Federal coal-mine inspectors designated by the Director of the Federal Bureau of Mines will make an investigation as to the cause of the disaster and make recommendations to prevent a recurrence.

c. After a disaster, when the mine has been placed in condition to operate, an inspection of such mine in its entirety will be made by Federal coal-mine inspectors, and if such inspection discloses any dangerous conditions, these will be reported to the mine operator or his representative, to the district officials of the mine workers organization, and to the Director of the Federal Bureau of Mines.

ARTICLE XI. - MISCELLANEOUS

Section 1. Mine map.

a. A map of the mine should be brought up to date at least every 6 months and be available at the mine. The map should show accurately:

1. Openings and plan of workings of each vein of coal, and the tunnels and passageways connecting the workings.
2. General inclination, in degrees, of the veins of coal.
3. Elevations (above and below sea level) at top and bottom of shafts, slopes, tunnels, and other permanent stations.
4. Boundary lines and barrier pillars.
5. Locations and elevations of sumps, dams, and other impounded water.
6. The directions of the air currents by arrows in colors.

Section 2. Protective pillars.

a. Barrier pillars should be left when workings are adjacent to old workings suspected of containing water, bodies of dangerous gas, or fire; a

barrier pillar should be of such width as may be determined by the engineers of the adjoining property owners and the State mine inspector of the district in which the mine is situated. Maps and other information concerning barrier pillars and impounded water should be available to Federal coal-mine inspectors.

Section 3. Approaching abandoned workings.

a. If the mine map reveals or conditions indicate that a place has been driven within 200 feet of worked-out or abandoned workings that cannot be inspected, or flushed areas or areas that may be filled with water or gas, boreholes should be kept at least 20 feet in advance of the face; similarly, 45° angle holes at least 25 feet in depth and not more than 8 feet apart should be drilled in the ribs. If the head of the impounded water exceeds 150 feet, the boreholes should be increased 1 foot in depth for each additional 10-foot head of water.

b. When a place is being driven to connect with any working place or with any accessible idle or abandoned place, the condition of the idle or abandoned place should be determined to be safe before the connection is made.

Section 4. Mine openings and escapeways.

a. Every underground mine should have at least two separate outlets to the surface. Note: It is not necessary that the two main outlets belong to the same mine if persons can travel in safety to and out of either outlet.

b. Each vein of coal and each level or gangway therein, where practicable, should have at least two travelable openings in connection with (directly or indirectly) both main outlets to the surface.

c. Main slope and drift openings should be separated by not less than 60 feet of natural ground (this applies only to future openings).

d. Mine openings at isolated locations where there is danger of fire should have adequate protection against surface fires entering the mine.

e. When a new mine is being opened or when a new gangway, tunnel, or level is being worked for the purpose of making a connection between the two main outlets, not more than 20 persons should be allowed at any one time in such mine, gangway, tunnel, or level.

f. When only one main outlet is available, owing to the final mining of pillars, not more than 20 persons should be allowed in any such section or mine at one time.

g. Escapeways should be kept in a safe condition and be reasonably free of standing water and other obstructions.

h. Separate manways or travelways should be provided where practicable; they should be maintained in good condition and be reasonably free of ice, steam, water, and obstructions; employees should use them.

i. Barrier gates that close automatically, overpasses, underpasses, or a signal to warn of approaching trips should be provided where a travelway crosses a mechanical haulage road.

j. Direction signs should be posted conspicuously to indicate designated travelways.

k. Where the escapeway is a shaft:

1. It should be equipped with hoist and cage, or with a travelable stairway if more than 30 feet in depth.
2. Equipped with a stairway; the stairway should be of substantial construction, set at an angle not greater than 45° with the horizontal, and equipped with suitable handrails; each landing platform should be at least 2 feet wide and 4 feet long and should be railed properly.
3. If not more than 30 feet deep, a ladder may be used in lieu of a stairway. The ladder should be fastened securely, and the rungs should be fastened securely, spaced equally, and not more than 15 inches apart.
4. A ladder or stairway should be kept in good repair and the landings kept free of debris.

l. Where an escapeway is a slope or plane inclined not more than 45° , it should be equipped with stairway or cleated walkway; if inclined more than 45° , it should be equipped with a stairway and handrails.

m. One of the designated escapeways should be an intake airway.

n. Abandoned slopes, shafts, air holes, and drifts should be properly fenced or the openings closed securely.

Section 5. Cap lamps and checking systems.

a. Only permissible electric lamps, preferably cap lamps, should be carried by all persons for illumination underground.

b. A check-in-and-out system should be adopted that will provide positive identification upon the person of each individual underground. An accurate record of the men in the mine should be kept in a safe place on the surface. Said record should bear a number identical to the identification check carried by the person underground.

Section 6. Arcs, sparks, and flames.

a. Because of explosion and fire hazards, all persons in the underground workings of a mine should not intentionally cause any arc, spark, or open flame, except those that cannot be avoided in the normal performance of work. The carrying of matches or other flame-making devices into a mine should be prohibited.

b. In gassy mines welding or cutting (with electricity or flame) in face regions and in returns should be done only in emergency and then under the immediate supervision of a certified official. Welding or cutting should not be done where methane can be detected with a flame safety lamp. In welding and cutting operations special precautions should be taken to prevent starting a fire.

Section 7. Protective clothing.

a. Safety caps or hats should be worn by all employees, officials, and others while on duty in mines and also on the surface where there is danger from falling objects.

b. Safety footwear should be worn by employees, officials, and others while on duty in and around mines, except office employees.

c. Employees inside or outside of mines should wear approved-type goggles where there is a hazard from flying particles.

d. Gloves should be worn when material is handled that may injure the hands, but gloves with gauntlet cuffs should not be worn around moving equipment.

e. Welders and helpers should use proper shields to protect their eyes.

f. Haulagemen and others who work around moving machinery or equipment should wear snug-fitting clothing.

g. Men exposed for short periods to gas, dust, fume, and mist-inhalation hazards should wear permissible respiratory equipment. When the exposure is for prolonged periods, other measures should be taken.

Section 8. Housekeeping underground.

a. Mine supplies and materials should be stored in an orderly manner; and travelways and passageways should be kept free of materials, debris, protruding nails, and other sources of injury. Supplies and tools in working places should be stored in an orderly manner so as to minimize stumbling hazards.

ARTICLE XIII. - GENERAL SAFETY CONDITIONS

Section 1. Duties, qualifications, and certification of persons employed underground.

a. The foreman or other person in charge of underground operations and all assistant foremen should have certificates of competency from the State.

b. A record of foremen's certificates should be kept at the mine.

c. In addition to the preshift examination, each working place should be inspected carefully for gas, oxygen deficiency, dangerous roof, and other hazards by a certified official at least twice each working shift, and as many more times as may be necessary.

d. Idle or abandoned sections of a mine should be inspected for gas and other dangerous conditions by the foreman or assistant foreman immediately before other employees are permitted to enter such sections.

e. A statement of the conditions observed by foremen and examiners, and the action taken if a hazard is found, should be recorded with ink daily in a book. The entries should be countersigned and dated by the mine foreman and the records kept available.

Section 2. Reporting of accidents.

a. The management of a mine should keep an accurate record of all accidents occurring at the mine that involve an injury to an employee (lost-time and no-lost-time accidents). A record of all accidents resulting in loss of time beyond the day of injury, together with the required employment and production data, should be reported on forms 6-1420 and 6-1420a to the Federal Bureau of Mines, Washington 25, D. C., at the end of each calendar month, except that a prompt report should be made to the Washington office of the Federal Bureau of Mines of an accident involving a fatality; the district office of the Bureau of Mines at Wilkes-Barre should be notified immediately by the most expeditious means.

Section 3. Reporting of hazards.

a. Any employee of a mine or any representative of the employees of a mine who discovers an unsafe condition in the mine should immediately report such unsafe condition to his supervisor.

Section 4. First aid and medical care.

a. Each mine should have an adequate supply of first-aid equipment to be used in case of injury to employees, and such supplies should be located on the surface and at suitable places underground. The first-aid supplies should be encased in suitable sanitary receptacles designed to be reasonably dusttight and moistureproof and should be available to all persons employed in the mine. In addition to the material in the cases, splints, blankets, and stretchers should be provided for the treatment of injuries and for the transportation of injured persons.

b. To treat, handle, and transport an injured person properly, employees should know the fundamentals of first aid.

c. When an injury occurs, a doctor should be notified immediately.

Section 5. Mine rescue.

a. At least 12 men should be trained in mine rescue work at mines employing 100 or more persons; at mines employing less than 100 persons a proportionately smaller number of men should be trained.

b. Mine rescue men should be retrained at intervals sufficient to assure their fitness and competency.

Section 6. Duty and responsibility.

a. It should be the duty and responsibility of employees and management to cooperate in carrying out the provisions of these standards.

ARTICLE XIII. - STRIP-MINING STANDARDS

Section 1. Breaker and cleaning plant.

a. Electric switches and controls in breakers and cleaning plants should be enclosed.

b. Where coal is dumped at or near air-intake openings, reasonable provisions should be made to prevent the dust from entering the mine.

c. Where repairs are being made to the plant, proper scaffolding and proper overhead protection should be provided wherever necessary.

Section 2. Stairways, housekeeping, and yards.

a. Stairways, elevated platforms or runways, and openings in floors should be equipped with handrails and toeboards, where necessary.

b. Ladders should be constructed substantially, anchored securely, well-maintained, and the rungs spaced suitably and uniformly. Backguards should be provided where necessary, such as at head frames and water tanks.

c. Good housekeeping should be practiced in and around mine buildings and yards. Such practices include cleanliness, orderly storage of materials, and the removal of possible sources of injury, such as stumbling hazards, protruding nails, and broken glass.

Section 3. Fire prevention.

a. Oil, grease, and similar flammable materials should be stored in closed containers separate from other materials to minimize fire hazards to nearby buildings and the mine. If oil or grease is stored in a building, the building or room in which it is stored should be of fire-resistive material and should be well ventilated.

b. Tight metal receptacles should be provided for oily waste.

c. Smoking in or about surface structures should be restricted to places where it will not create a fire hazard.

d. Unless structures within 100 feet of mine openings are of fire-proof or fire-resistive construction, fire doors should be erected at or near the portals or at other effective points in the mine openings if smoke or fire from outside sources might endanger men working underground. These doors should be tested at least monthly to assure effective operation.

e. Not over 5 gallons of gasoline should be stored in a warehouse. The containers should be painted a conspicuous color, preferably red, and marked "Gasoline." The containers should be provided with tight covers for the spout and the can.

f. Highly flammable liquids such as gasoline and naphtha should not be used to clean machine parts.

Section 4. Mining methods, conditions, and equipment.

a. Stripping and drilling overburden.

1. While stripping, the bank or banks should be sloped as much as possible and all loose material removed to prevent slides. Overhanging ledges should not be permitted. Pits should be adequate in width and kept well drained.
2. When box cuts are made in thick cover, the spoil should be moved back from the face of the cut to prevent material from rolling back onto workmen in the pit.
3. Workmen in the pit should keep constantly on the alert for slides, rock, or dirt falling from the face of the bank and the spoil piles, especially during intermittent freezing and thawing weather.
4. Where churn drills or vertical rotary drills are used for drilling overburden, the drillers should not work under suspended tools. When collaring holes, inspecting, or during any operation where tools are removed from the hole, the tools should be lowered to the platform.
5. Vertical holes should be protected by covering them or leaving at least 1 foot of casing above the ground level.
6. When a churn or vertical rotary drill is in operation, the driller or his helper should be at the controls.
7. Drilling equipment should be maintained in safe condition.

Section 5. Explosives and blasting.

a. Main storage magazines.

1. Separate surface magazines should be provided for the storage of explosives and detonators.
2. A surface magazine for storing high explosives in amounts exceeding 125 pounds should be:
 - a. Reasonably bulletproof and constructed of incombustible material or covered with fire-resistive material. If a magazine is so located that it is possible to fire bullets directly through the roof into the explosives, the roof should be made bullet-resistive by material of construction, or by a ceiling that forms a tray containing not less than a 4-inch thickness of sand, or by other methods.

- b. Provided with a door or doors constructed of 3/8-inch steel plate lined with a 2-inch thickness of wood, or of a thinner steel plate with a greater thickness of wood at the ratio of 1 additional inch of wood for each 1/8-inch decrease in the thickness of the steel plate, or of other materials which will make them at least equally fire- and bullet-resistive.
 - c. Provided with a floor made of wood or other nonsparking material and have no metal exposed inside the magazine.
 - d. Provided with suitable warning signs so located that a bullet passing directly through the face of a sign will not strike the magazine.
 - e. Provided with properly screened ventilators.
 - f. Provided with openings for entrance and ventilation only.
 - g. Kept locked securely when unattended.
 - h. Grounded, if constructed of metal or if metal covered.
- 3. Surface magazines for storing black blasting powder or detonators need not be bulletproof, but they should be in accordance with the other recommendations for storing high explosives.
 - 4. High explosives or black blasting powder in amounts of 125 pounds or less or 5,000 detonators or less should be stored in accordance with Section 1b and 1c, or in box-type magazines. Box-type magazines may also be used as distributing magazines when the quantities do not exceed those mentioned. Box-type magazines should be strongly constructed of 2-inch hardwood or 3-inch softwood or other equally substantial material. A metal magazine should be lined with nonsparking material. No magazine should be placed in a building containing oil, grease, gasoline, waste paper, or other highly flammable material, nor should a magazine be placed less than 20 feet from a stove, furnace, open fire, or flame.
 - 5. Where practicable, permanent explosives-storage magazines should be not less than 200 feet from any vital structure, or from any mine shaft, tunnel, or slope opening to the surface.
 - 6. A magazine used for the distribution of explosives or detonators on the surface should be built in accordance with the standards for the construction of a storage magazine. The supply kept in a distributing magazine should be limited to not more than 3 days' supply or more than 3,000 pounds of explosives. Explosives and detonators may be distributed from the same magazine if separated by at least a 6-inch substantially fastened hardwood partition or the equivalent.

7. The area surrounding the magazine for not less than 25 feet in all directions should be kept free of rubbish, dry grass, or other materials of a combustible nature.
 8. If the explosives magazine is illuminated electrically, the lamps should be of explosion-proof type and the wiring in conduit. The switch should be outside the building.
 9. Only nonmetallic tools should be used for opening any type of explosives container. Extraneous materials, other than blasting supplies, should not be stored in an explosives or detonator magazine.
 10. Smoking, carrying smokers' articles, or open flame should be prohibited in or near any magazine, or while explosives or detonators are being handled.
- b. Transportation of explosives and detonators.
1. Vehicles used in the transportation of explosives or detonators should be constructed substantially and maintained in good working order. Any exposed metal on the inside of the body that might come in contact with any package of explosives or detonators should be covered or protected with wood or other nonmetallic material. Explosives in open vehicles should be covered with tarpaulins.
 2. State or other regulations as to marking vehicles transporting explosives should be followed. If no laws or regulations are in effect, any such vehicle should be placarded on the front, each side, and the rear with the word "EXPLOSIVES" in letters not less than 3 inches high or should display a red flag with the word "DANGER" in white letters not less than 6 inches high.
 3. Preferably, explosives and detonators or blasting caps should not be transported in the same vehicle. If they are transported in the same vehicle, they should be separated by at least a 4-inch substantially fastened wood partition or the equivalent. Other materials should not be hauled in the same load with detonators or explosives.
 4. Explosives should not be transported in any form of pole-type trailer, nor should any such trailer be attached to a vehicle hauling explosives.
 5. Unauthorized persons should not be permitted to ride on vehicles transporting explosives, and the driver and helper should neither smoke nor carry matches or lighters.
 6. Explosives should be transported in the original shipping containers or in some other suitable container.
 7. Vehicles transporting explosives should be brought to a full stop before crossing any railroad track or main public highway. Truck drivers should conform to all other traffic safety measures.

8. A vehicle containing explosives should never be left standing or unloaded without first stopping the motor and setting the brakes securely and should never be taken into a garage or repair shop. Explosives cases should never be left immediately back of the exhaust pipe, as a spark may cause an explosion or start a fire.
 9. Explosives or detonators should never be left unattended unless they are in locked magazines.
 10. Loose detonators should be placed in approved insulated containers and carried to the place of use by the blaster or other responsible persons.
 11. Explosives and detonators should be brought to the place of use in the original unopened containers or in separate insulated containers and kept there until removed for placement in drill holes.
 12. Capped fuse should be carried in covered, insulated containers separate from those containing explosives.
- c. Pit storage.
1. Operation storage boxes should be used to store explosives and detonators in the pit. Not more than a 24-hour supply of explosives and detonators, including any surplus remaining from the previous day, should be stored in these boxes. To avoid deterioration of explosives, older explosives should be used first.
 2. If pit operation boxes or magazines are provided, they should be:
 - a. Located not less than 200 feet from the actual blasting or from any operating unit, and at least 25 feet from tracks, roadways, travelways, or power cables.
 - b. Kept locked except when in use.
 3. When operation boxes or magazines are used, the explosives and detonators should be kept in separate boxes or magazines; however, if kept in the same box, they should be separated by at least a 4-inch substantially fastened hardwood partition, or the equivalent.
- d. Blasting practices.

1. Blasts should be charged and fired by certified or authorized persons.
2. All holes for blasting should be proved before the explosives are inserted therein. Small blast holes, less than 3-inch diameter, may be tried with an ordinary tamping stick; well-drill holes may be proved with a "dolly" or tamping block. A mirror or flashlight may be used for visual inspection.

3. Each blast hole should be cleaned properly before the charge is placed in the hole.
4. Water standing in well-drill holes should be bailed out, if possible, and the holes should be loaded with an explosive of adequate water resistance.
5. Explosives which are so hard that a punch cannot be inserted for priming, or which are believed to be substandard in any other respect, should not be used.
6. Only low-freezing or nonfreezing explosives should be used where subzero temperatures prevail. If explosives are believed to be frozen, no attempt should be made to use them or thaw them, but rather the manufacturer should be consulted.
7. Detonators and electric detonators should be kept separate and apart from other explosives until ready to be used.
8. It is recommended that primers be made up just before they are placed in a hole.
9. Primers should be made in accordance with the data published by the makers of explosives.
10. Great care should be taken to insure that detonators are securely fastened in the primer cartridge.
11. The long axis of the detonator should lie as nearly as possible in line with or parallel to the long axis of the primer cartridge, and the detonator preferably should point toward the bulk of the charge of explosives.
12. Blast holes should be stemmed to assure maximum efficiency from explosives. Stemming material should be free from coarse pieces.
13. High explosives in small blast holes should be tamped with only enough force to collapse the cartridges. Excess ramming should be avoided. The primer cartridge should never be tamped.
14. A blast should not be fired until all surplus explosives and detonators have been removed from the immediate vicinity, preferably returned to the magazine or operation box.

NOTE: Safety fuse is manufactured by several companies and is obtainable in two standard rates of burning. The manufacturers of safety fuse make no warranty or representations as to the burning speed of their product owing to the many circumstances and conditions to which the fuse is subjected after leaving the factory, including differences in altitude, weather conditions, storage, and character of tamping and mishandling, all of which may affect the burning speed of the fuse. However, every care and precaution are used in the manufacture of safety

fuse to have it burn at a standard rate of 1 foot in either 30 seconds or 40 seconds, with an allowable variation of 10 percent either way from standard when burned in the open at sea level.

15. Block holes should be used whenever practicable. The hole should be drilled deep enough to accommodate the charge of explosives as well as sufficient stemming to confine the charge.
16. "Mudcap" or "adobe" charges should be completely covered with stemming material. Two or more charges should not be used on the same boulder unless the charges are fired electrically or with detonating fuse.
17. The minimum length of fuse to be used in block-hole or "mudcap" blasts should be as required by State law or as established by the management, but should not be less than 30 inches.
18. Blasters or shot firers should always use sufficient fuse in conjunction with an adequate warning signal or system to permit them to reach a safe place before the first hole fires.
19. Blasters or shot firers should know the burning rate of the fuse that is being used. Tests to determine the burning rate of fuse should be made of each new shipment and the results posted.
20. An effective type of lighter should be used in lighting fuse. Several types of good lighters are on the market.
21. The use of cigarettes, burning paper, improvised torches, or matches for lighting fuse should be prohibited.
22. The allowable number of block-hole fuses to be lighted by a blaster at one time should be determined by the management. Normally, not over 12 fuses should be lighted by each blaster.
23. When preparing fuse for capping, the end to be inserted in the detonator should be cut squarely across with a clean, sharp blade or cutter and seated lightly against the charge. The detonator should be crimped tightly, using only a hand or bench-type crimper.
24. Electric detonators should be tested individually with a blasting galvanometer before being used. The circuit should be tested with a blasting galvanometer before the blast is fired.
25. The leg wires of electric detonators should be short-circuited after testing and should remain so until they are connected into the circuit.
26. Electric detonators used in well-drill holes, or long small blast holes, should be tested several times during loading of the hole and should be short-circuited again after each test. Two electric blasting caps frequently are placed in each well-drill hole.

27. No means other than a blasting galvanometer containing a silver chloride cell manufactured for the purpose should be used for testing electric detonators or blasting circuits.
28. When firing electrically, the insulation on all firing lines and leading lines should be adequate and in good condition. The firing lines and leading lines should be adequate in length to assure the safety of the shot firer.
29. When firing electrically, all firing lines and leading lines should be short-circuited at the power source end until ready to blast. The lines should be staggered as to length at the detonator end.
30. Stranded wires should not be used in a blasting circuit.
31. Duplex leading wire should not be used, except for firing single electric detonators.
32. Firing lines and leading lines should be kept away from track, pipe lines, power wires, and other sources of active or stray currents.
33. When firing from a power circuit, fuses of adequate capacity should be installed in the power line near the master firing switch.
34. When firing electrically, a 2-conductor circuit should be used throughout.
35. When firing from a power circuit, a master switch should always be used. It should be locked in "Open" position at all times, except when firing. Keys to the master switch should be entrusted only to the person designated to fire the blast.
36. When firing from a power circuit, one or more safety switches should be placed in the permanent firing line in addition to the master switch used for firing. There should also be a gap at least 5 feet long in both wires of the firing lines, or between the firing lines and the leading lines; this gap should be near the master switch or at some other safe location. All switches should be short-circuited in the "Off" position but not grounded.
37. Blasts detonated with electric detonators should be fired from a source of current of ample capacity.
38. When firing with a blasting machine, the machine and the detachable handle or key of its lock should be kept in the possession of the person designated to fire during the connecting of the blast and until the blast has been fired.
39. When firing with a blasting machine or battery, the leading wires should not be connected until immediately before firing

and should be disconnected immediately thereafter. The number of detonators connected in series should not exceed the rated capacity of the blasting machine.

40. The blasting machine should be kept in good condition and tested at regular intervals. The use of a rheostat for testing purposes is recommended.
41. Drill holes which have been sprung or chambered, and which are not water-filled, should be allowed to cool as long as practicable before explosives are loaded. The time required for cooling varies with the quantity and kind of explosives used in springing, and also with the type of rock. With small charges of explosives, at least 1 to 2 hours cooling time should be allowed; and with large charges, usually 4 or 5 hours are required. Explosives manufacturers generally recommend quick-acting ammonia dynamites, preferably gelatinous types, for springing holes.
42. The use of "short fuses" should be prohibited when springing holes.
43. A blast hole should never be sprung when it is adjacent to or near a hole that is charged. This is of especial importance in ground that is fissured, broken, or wet.
44. While explosives are being loaded in drill holes, all persons not necessary in connection with the blasting operations should be barred from the vicinity.
45. Detonators or other explosive material that is not to be used in the blast should not be allowed in the vicinity of the loading area.
46. Large dynamite cartridges may be dropped in smooth well-drill holes but should not be dropped unless the hole is free from obstructions throughout its entire length.
47. Large dynamite cartridges should not be dropped in well-drill holes containing excessive water until the charge is above the water level.
48. Large dynamite cartridges that have wedged in a well-drill hole should not be tamped with a "dolly;" but rather, after pouring water into the hole, attempts to dislodge or pierce the cartridges should be made with a spear-shaped wooden tamping block or a small-diameter wooden pole such as recommended by the explosives manufacturers.
49. Rough or ragged holes and holes closed partly by an obstruction that cannot be removed readily should be loaded with cartridge dynamite lowered with a rope, with free-running dynamite, or with dynamite cut in small pieces.

50. When more than one crew is loading a long line of holes, the crews should be separated by the greatest practical distance that can be maintained as the loading operations progress and that is consistent with efficient operation and supervision of the crews. Every effort should be made to keep the loading crews a minimum of 25 feet apart and to prevent simultaneous loading of adjacent holes.
51. When drill holes are to be loaded for blasting, the explosives containers should be stacked in piles at least 25 feet, and preferably farther, from the nearest drill hole to be loaded. For a given total amount of explosives in the loading area, it is preferable to have a few piles each containing relatively large quantities of explosives rather than to have a large number of piles each containing a small quantity. The containers should be opened at the piles as needed and the opened explosives cases carried one at a time to the loading station. This station should be at least 6 feet from the hole to be loaded, or from any unstemmed loaded hole, and at least 25 feet from the main pile. The quantity of explosives at this point should not exceed 100 pounds. From this station the explosives should be passed one cartridge or unit at a time for loading into the hole. Empty cases and lining paper should be removed immediately to a waste pile.
52. Excessively large quantities of explosives should not be delivered to the loading area at one time. If deliveries of explosives are made by truck, the quantity permitted at or near the loading operations should be limited to one truck load. Other trucks loaded with explosives should wait or be unloaded in separate safe places away from the loading operations.
53. When explosives for a blast cannot be delivered to the loading area by truck or railroad and must be carried to the holes by men, the same care should be taken to avoid having excessively large amounts of explosives in one area.
54. Explosives should be delivered first to the holes farthest from the truck to avoid driving or walking among piles of explosives.
55. Explosives in excess of immediate requirement, when removed from the main storage magazine and delivered in the vicinity of a blasting operation, should be stored in a portable magazine, or in a small building if protected by a guard, until the explosives are used, or should be stored in other suitable places properly protected against theft.
56. Enough suitable stemming material should be placed by each hole before the delivery of explosives to the holes is started.
57. Stemming should be placed in each hole as soon as practicable after loading of the explosives has been completed, being careful to protect the detonating fuse or leg wires of electric detonators from damage.

58. Black powder should not be loaded into holes when there is any danger from sparks, flame, or other sources of ignition. All equipment that emits sparks should be removed or closed down during loading operations.
59. Explosives in well-drill holes may be tamped with a "dolly" when tamping is required, but the use of a "dolly" should be kept at a minimum. Extreme care should be taken not to damage the detonating fuse or leg wires of electric detonators when tamping with a "dolly."
60. Tamping sticks, "dollies," or blocks should be made of wood with no exposed metal parts. Jointed wooden tamping sticks with exposed couplings made of nonsparking material may be used.
61. Only holes that are to be blasted immediately should be loaded.
62. When well-drill holes are primed with detonating fuse, it should be lowered to the bottom of the hole either by attaching it to the first cartridge or by other means. It should then be cut from the reel and the reel moved well away or to the next hole before any other explosives are loaded. The detonating fuse should extend from the hole a distance of 2 or 3 feet to compensate for any subsidence and should be drawn taut and made secure on the top where it will not interfere with loading operations or come in contact with explosives on the ground. It should be checked each time before stemming material is used to see that it has not been broken.
63. When detonating fuse is used, main- or trunk-line splices should be factory splices or tight square knots. No splices should be used in the drill hole.
64. Branch-line connections and connections in the main line other than splices should be tight and at right angles.
65. Main or trunk lines should be laid out free of kinks or coils and all connections should be inspected before firing the blast.
66. When a detonator or an electric detonator is connected to detonating fuse, a connector for the purpose should be used, or it should be taped or otherwise attached securely alongside and at the end of the detonating fuse with the end of the detonator containing the explosive charge pointed in the direction in which the detonation is to proceed. Detonators should not be brought to the loading area nor attached to the detonating fuse until all is in readiness to fire the blast.
67. Plain detonating fuse may be used for trunk lines or in shallow drill holes, but reinforced or wire-protected types should be used in deep or ragged holes.
68. Warning signals should be given, and workmen required to retreat to a safe place, before the shots are fired.

69. Guards should be posted on the surface when overburden is being blasted, to prevent anyone from approaching the vicinity of the blasts.
70. After multiple shots are fired, a careful examination should be made for misfires by an authorized person before workmen are permitted to return to the vicinity.
71. Each misfire presents an individual problem and should be handled under the personal supervision of the blasting foreman or pit foreman. Extreme care should be used in handling mis-fired holes.
72. In the case of a misfired hole, the stemming should be removed to within approximately 12 inches of the explosives, when possible, using a jet of water or by spooning in holes over 3 inches in diameter. A primer should be placed in the hole, and fired as usual. This will generally detonate the unexploded charge. For further suggestions in the handling of misfired holes, refer to pamphlet entitled "Safety in the Handling and Use of Explosives," published by the Institute of Makers of Explosives, 343 Lexington Avenue, New York 16, N. Y.
73. Special precautions should be taken when blasting in strip mines adjacent to underground workings. Where such conditions exist, blasting should be done only when all men have been removed from the underground workings. The underground workers should not be allowed to reenter the underground mine after the blasting operations in the strip mine until a thorough search for carbon monoxide and other toxic gases is made in the underground mine and any dangerous gases are removed.
74. Explosives should not be transported, handled, or used immediately before or during an electrical storm.

e. Liquid-oxygen explosives.

The following requirements apply to the use of liquid-oxygen explosives:

1. Persons authorized to handle and use liquid-oxygen explosives should be instructed in their properties and characteristics so that they may better comprehend the necessity for safe handling and use of this explosive.
2. Liquid-oxygen plants should be in isolated locations away from other buildings, railroad tracks, or highways and should be protected from unauthorized visitors by a tight fence on which warning signs should be posted. The fence gate should be kept locked unless authorized persons are present.
3. Smoking should be absolutely prohibited in or near the building where liquid oxygen is manufactured or the soaking of cartridges is done. Men should be searched for smokers' articles before

being permitted to enter a building where liquid oxygen is manufactured, or cartridges are soaked.

4. Precautions should be taken to prevent the ingredients, such as carbonaceous absorbent, liquid oxygen, the containers, or the finished cartridges, from being contaminated with rusty pieces of metal, oil, grease, paint, or other foreign materials that may increase the sensitivity of the explosives.
5. The cartridge bag should be strong enough to prevent breakage when the cartridge is charged into the hole and woven closely enough to prevent the absorbent from sifting out during handling.
6. The end of the cartridge bag should be closed securely to prevent spillage of the contents in handling and charging.
7. The diameter of the finished cartridge should be checked to prevent loading oversize cartridges that might lodge in the bore-holes.
8. Cartridges should be soaked in a room separated from the main part of the plant or in a closed, fire-resistant building.
9. The absorbent should be one that will give an explosive with a minimum of sensitivity.
10. Soaking boxes should be inspected frequently and kept in good condition. They should be kept clean and free of loose absorbent or other sediment.
11. Explosion-proof lights should be provided in the soaking room.
12. The cartridges should not be touched or handled with any implement unless such implements are made entirely of wood, plastics, or other nonsparking or nonconductive material.
13. Preferably liquid-oxygen explosives should be fired with detonating fuse, because of the safety features of this fuse and its efficiency at low temperature.
14. If electric detonators are used, they should not be placed in the priming cartridge until immediately before placing the primer in the hole, and the primer should be the last to be inserted in the hole. Only detonators suitable for liquid-oxygen explosives should be used.
15. The holes should be charged deliberately and systematically. Even with liquid-oxygen explosives, speed should not be emphasized unduly. The cartridges should not be dropped or forced into a borehole; they should be lowered slowly by means of a rope.
16. Lodged, hung, or misfired cartridges should be left untouched until the oxygen has evaporated.

17. The practice of soaking cartridges during transportation should be prohibited if it is possible to do otherwise.

Section 6. Haulage.

- a. Surface haulage - railroads.
 1. Track and roadbed should be maintained in good condition.
 2. Switch throws should be so installed as to provide adequate clearance for switchmen.
 3. Derail devices should be installed where necessary on all side-tracks near junctions with main lines and at other places where needed.
 4. In handling railroad cars, a brakeman should use a suitable brake stick, wear a protective hat where there is danger from falling material, use a railroad-type pinch bar for shifting cars, and wear snug-fitting clothing.
- b. Surface crossings.
 1. Where surface operations require that many persons pass over the haulageway, a warning signal should be installed or an overhead walkway or underpass provided.
 2. Railroad and mine-surface track crossings should be provided with warning signs.
 3. Grade crossings should be eliminated as far as practicable. The crossings should be planked or filled between the rails; they should have "Stop" signs on each side of the track; and the track should be visible in both directions from the crossing as far as it is possible to arrange.
- c. Surface inclines.
 1. On slopes and planes having a knuckle, there should be a positive-acting stopblock or derail at or above the knuckle, and a derail near the bottom if men are endangered.
 2. Employees whose duties require them to work near the bottom of inclines should retreat to safe places while cars are being handled on the inclines.
- d. Pit haulage - railroad equipment and operation.
 1. Rails should be heavy enough to carry safely the heaviest rolling stock and should be firmly attached to ties of adequate size and spacing.
 2. Roadbeds should be kept well drained and surfaced.

3. The permanent track should be alined properly and free from broken rails, defective switches, and defective or improperly alined frogs.
4. Temporary tracks should be well-blocked and sufficiently well-ballasted to hold.
5. On haulage roads, rail joints should be connected with plates and rails well-supported by ties.
6. Complete track switches should be provided.
7. Frogs, guardrails, and lead rails should be blocked where there is danger of persons catching their feet in them.
8. Haulage equipment should be inspected daily and maintained in safe condition.
9. Locomotive boilers and their appurtenances should be thoroughly inspected semiannually, internally and externally, and under operating conditions, by a competent inspector; they should not be operated at steam pressures in excess of the safe working pressure stated in the certificate of inspection.
10. Locomotives should be equipped at both ends with firmly fastened grab irons and stepboards maintained in good condition.
11. Each locomotive should be equipped with a gong or other warning device and be handled carefully and kept under control at all times. A locomotive should be equipped with effective headlights if used at night.
12. Locomotives should be equipped with rerailers and track jacks at all times, unless such equipment can be quickly and easily secured from a central supply point.
13. Only authorized persons should operate locomotives.
14. Riding on locomotives should be prohibited except to those operating the trip and persons authorized by the management.
15. Riding on top of loaded cars, between cars, or on bumpers in front of cars should be prohibited.
16. Locomotive engineers should sound a warning signal when approaching stripping equipment and should not attempt to pass a shovel or dragline until the all-clear signal is given by the shovel or dragline operator.
17. Cars that are not coupled to locomotives should be blocked securely while being loaded. If cars have brakes, they should be set also.

18. Cars not equipped with automatic couplers should not be coupled or uncoupled by hand while they are in motion unless a coupling hook or other equally effective device is used. Flying switches should be prohibited.
 19. Rocker- or cradle-type dump cars should be equipped with an efficient locking device.
 20. "Poling" or moving a car on another track with a pole should be done only in an emergency. The pole should be placed against the car to be pushed and the engine brought to the other end of the pole and the bumper held tightly against the pole. The car should not be pushed until all persons are in safe places.
 21. Cars should not be left on sidetracks unless ample clearance is left for the main-line transportation.
 22. Standing cars should be well-blocked and have the hand brakes set tight regardless of grade. If the track leads into a place where men are working, a derailer or derail switch should be installed.
 23. Workmen required to do repair work under equipment such as locomotives and cars should be protected by a portable derailer or by a suitable signal to warn trainmen against making a coupling.
 24. When cars of materials or supplies are being loaded or unloaded, suitable signs should be placed at both ends of the car or train to warn trainmen against making a coupling.
- e. Pit haulage - automotive equipment and operation.
1. Trucks should be inspected daily and maintained in safe condition.
 2. Trucks should be "warmed up" in the open and never in the garage.
 3. Trucks should be handled carefully and kept under control at all times. They should be provided with efficient headlights and warning devices.
 4. Only authorized persons should operate trucks.
 5. Truck drivers should sound a warning signal when approaching the stripping equipment and should not attempt to pass a shovel or dragline until they receive the return signal from the shovel or dragline operator.
 6. During dry weather, main haulage roads should be kept sprinkled, or other methods of allaying dust should be used. During icy or slippery weather, sand, fine cinders, or fine coal should be used on ramps and driveways.

7. When trucks are traveling in the same direction, drivers should maintain safe distances between trucks.
8. Truck roads leading from the pit to the surface should be arranged to provide one-way traffic, particularly if the road is on a steep grade. If this is not practicable, the road should be wide enough to accommodate free passage of trucks, or definite turn-outs and waiting points should be designated.
9. Persons should be prohibited from working on the chassis of a truck with the truck body in a raised position until after the truck body has been securely blocked in position. The mechanical hoist mechanism should not be depended upon to hold the truck body in a raised position.
10. A substantial bumping block to stop a truck backing, or a safety hook designed to engage the front axle, should be provided at places where a rear-dump truck discharges its load, unless the load is being dumped for spreading.

Section 7. Electricity.

a. Surface transmission lines.

1. Overhead high-potential power lines should be placed at least 15 feet above the ground and 20 feet above driveways and should be supported and guarded adequately to prevent contact with other circuits.
2. Poles should be planted firmly in the ground and should be well-guyed at turns and dead ends.
3. Insulators should be adequate in quality and design for the voltage transmitted. At dead ends, or at points where abrupt turns are made in the transmission lines, strain insulators should be used.
4. Surface electric equipment and overhead power circuits should be protected adequately against lightning or voltage surge.
5. High-potential power lines should be protected adequately by circuit breakers.

b. Surface transformer stations.

1. Unless transformers are isolated by elevation (8 feet or more above the ground), they should be surrounded by a suitable enclosure. If the enclosure is of metal, it should be effectively grounded.
2. The gate or door to the transformer enclosure should be kept locked at all times unless authorized persons are present.

3. If surface transformers containing flammable oil are installed where they present a fire hazard (in or near combustible buildings), means should be provided to drain or confine the oil if the transformer casing is ruptured.
4. Casings of all transformers should be grounded unless protected by isolation (freedom from contact by position).
5. "DANGER - HIGH VOLTAGE" signs should be placed on all transformer enclosures, high-potential switchboards, and other high-potential installations.

c. Substations.

1. Switchboards should:
 - a. Have ample working space around and back of them, free of rubbish and stored material.
 - b. Have an entrance at one end (both ends, where feasible) to permit authorized persons to inspect, adjust, or repair apparatus back of switchboard.
 - c. Be adequately lighted.
 - d. Have control readily accessible for emergency shut-down.
 - e. Have a disconnecting switch on incoming power circuits.
 - f. Have entrance to rear guarded against unauthorized entrance.
- d. General (surface electricity).
 1. Rheostats and electric heaters should be installed so as to prevent fire, electric shock, or burn-injury hazards.
 2. Switches and circuit breakers should be installed so that they are readily accessible and can be operated without danger of contact with moving or live parts.
 3. Electric wiring in surface buildings should be installed so as to present minimum fire and contact hazards.
 4. Electric appliances, machines, and conductors should be large enough for the required work.
 5. Metallic coverings and armor of cables, conduit, and grounding conductors should be electrically continuous and grounded effectively.
 6. Metallic frames, casings, and coverings of motors, generators, switchboards, and other electric equipment that can become "alive" through failure of insulation or by contact with energized parts should be grounded.

7. Ground connections should be tested frequently to determine their continuity and occasionally to determine their resistance.
8. The metal frames of drills and other electric tools intended to be held in the hands while being operated should be grounded effectively.
9. Dry wooden platforms, rubber mats, or other electrically nonconductive material should be kept in place at all switchboards and stationary machinery where shock hazards exist.
10. Wires or other conducting materials should not be used as a substitute for properly designed fuses.
11. Electric equipment should be protected against excessive over-load by fuses or equivalent protective devices of the correct type and capacity.
12. Fire extinguishers approved for electrical fires should be provided at all electric installations. If such extinguishers cannot be obtained, dry sand or rock dust should be available.
13. Trolley wires should be:
 - a. Kept taut and securely supported by enough insulated hangers to prevent sag.
 - b. Adequately guarded where men are required to pass under the wire, unless the wire is 6-1/2 feet or more above the top of the rail.
14. If track is used for the return circuit, both rails should be bonded at every joint and cross-bonded at least every 200 feet.
- e. Pit electric installations and equipment.
 1. Electric equipment should be provided with switches of safe design, construction, and installation.
 2. A suitable cut-out switch should be installed at branch circuits adjacent to main lines.
 3. Cut-out switches should be marked so that they may be found readily in an emergency.
 4. Circuit breakers should be provided to protect power circuits. If they are automatic, they should be set so that the circuits cannot be overloaded; if they are hand-set, the handles should not be tied in place.
 5. Trailing cables should be properly protected against mechanical injury at all places where trucks and other vehicles are required to cross.

6. Cables should be of ample thermal capacity and mechanical strength for the service intended. Preferably, the individual conductors of trailing cables carrying above 600 volts should be shielded.
7. Cables should be examined regularly and any defects found in the cable should be repaired immediately.
8. Cable splices should be made in a workmanlike manner, mechanically strong, and well-insulated. Preferably, when a cable is defective, a standby cable should be used and the defective cable sent to the shop for permanent splicing and vulcanizing.
9. Portable transformers should be enclosed in a transformer house or by a substantial fence at least 6 feet high. The opening to the enclosure should be locked when the transformers are near a public road or if they are not under constant surveillance of authorized employees.
10. The casings of transformers, unless isolated from contact by position, and the frames of other equipment should be grounded.
11. Power should be disconnected when repair work is being done on electric equipment, transmission lines, and accessories such as trailing cables, switches, and junction boxes.
12. Cables carrying in excess of 440 volts should be handled with suitable insulating hooks when the power is on. Cables carrying 440 volts or less should be handled with rubber gloves or insulating hooks.
13. Electric equipment should be inspected daily and maintained in safe condition.

Section 8. Additional safeguards for mechanical equipment.

a. Shop equipment.

1. The following should be guarded adequately:
 - a. Gears, sprockets, friction devices, and couplings with protruding bolts or nuts.
 - b. Shafting and projecting shaft ends that are within 7 feet of floor or platform level.
 - c. Belt, chain, or rope drives that are within 7 feet of floor or platform.
 - d. Fly wheels. (Where fly wheels extend more than 7 feet above the floor, they should be guarded to a height of at least 7 feet.)
 - e. Circular and band saws and planers.

- f. Repair pits. (Guards or covers should be kept in place when the pits are not in use.)
- 2. Machinery should not be repaired or oiled while in motion, unless such oiling can be done without danger to the oiler.
- 3. A guard or safety device removed from any machine should be replaced before the machine is put in operation.
- 4. Mechanically operated grinding wheels should be equipped with:
 - a. Safety washers and tool rests.
 - b. Substantial retaining hoods, the hood openings of which should not expose more than 90° sector of the wheel.
 - c. Eyeshields, unless goggles are worn by the operators.
- b. Stripping and loading equipment.
 - 1. Operators of shovels, draglines, and tractors should not operate their equipment when any persons are in such proximity as to be endangered. The equipment should be provided with efficient warning devices.
 - 2. Operators of stripping equipment should not swing the dipper or bucket over passing haulage units.
 - 3. Operators of loading shovels should swing the dipper over the body of the truck and never over the cab.
 - 4. Dippers should be lowered to or near the ground for repairs. Men should not work under a suspended dipper, and no person should be permitted to ride in a dipper or bucket.
 - 5. Stripping and coal-loading equipment should be inspected daily. Particular attention should be given to the condition of the cables. Hoist and counterweight ropes should be inspected daily. Boom suspension cables should be inspected at regular intervals, but not less than once a month.
 - 6. Walkways and platforms on shovel and dragline booms should be maintained in safe condition. The walkways and platforms should be equipped with safe handrails.
 - 7. Men should not be permitted to get on or off draglines or shovels in operation without notifying the operator.
 - 8. Men should not be permitted within the sector of shovels or draglines unless in the line of duty.
 - 9. Good housekeeping should be practiced on shovels and draglines.

10. Oil and grease should be stored in closed metal containers and in such a manner as not to present a fire hazard.
11. Stripping and coal-loading equipment should be well-illuminated if used on the night shift. Tractors should be equipped with efficient headlights for the night-shift operations.

Section 9. Miscellaneous hazards.

- a. Lighting.
 1. Adequate illumination should be provided for men on the night shift. Preferably, electric cap lamps or flashlights should be used when portable lights are required.
 2. Extension cord lamps with exposed metal sockets should not be used.
- b. Protective clothing.
 1. Protective hats should be worn by persons where there is danger from falling objects.
 2. Protective footwear should be worn by persons while on duty around mines.
 3. Men exposed to dust-inhalation hazards should wear permissible dust respirators.
 4. Men should be required to wear safety goggles when using grinding tools and when doing other work where particles are likely to fly.
 5. Welders and helpers should be provided with proper shields to protect their eyes.
 6. Gloves should be worn when material is handled that may injure the hands. Rubber gloves that are in good condition should be worn by employees when doing work that requires them to come in contact with electric equipment involving shock hazard.
 7. Haulage men and others who work around moving machinery should wear snug-fitting clothing.

Section 10. General safety conditions.

- a. Safety rules and standards.
 1. New employees should be fully instructed regarding the company safety rules and the particular hazards incident to their work; this applies to both experienced and inexperienced personnel.

b. Reporting of accidents.

1. The management of a mine should keep an accurate record of all accidents at the mine that involve an injury to an employee (lost-time and no-lost-time accidents). A record of all accidents resulting in loss of time beyond the day of injury, together with the required employment and production data, should be reported on forms 6-1420 and 6-1420a to the Federal Bureau of Mines, Washington 25, D. C., at the end of each calendar month, except that a prompt report should be made to the Washington office of the Federal Bureau of Mines of an accident involving a fatality; the district office of the Bureau of Mines at Wilkes-Barre should be notified immediately by the most expeditious means.

c. First aid.

1. Adequate first-aid material should be provided near the pit and kept in clean, usable condition.
2. Instructions in artificial respiration should be posted at every electrical station, and all employees working with or around electric equipment should know how to give artificial respiration.
3. To treat, handle, and transport an injured person properly, employees should know the fundamentals of first aid.

d. Duty and responsibility.

1. It should be the duty and responsibility of employees and management to cooperate in carrying out the provisions of these standards.

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